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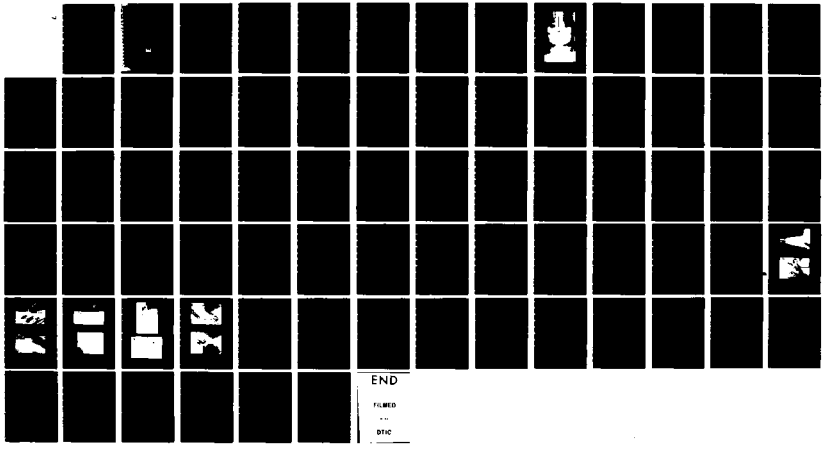

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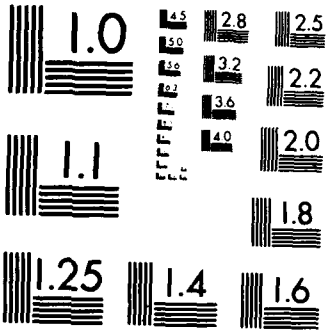

HOCKANUM RIVER BASIN
VERNON, CONNECTICUT

SHENIPSIT LAKE DAM
CT. 00209

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

SEPTEMBER 1978

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
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18. SUPPLEMENTARY NOTES

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Hockanum River Basin
Vernon, Conn.
Shenipsit Lake Dam

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The Shenipsit Lake Dam is a granite stone masonry structure 70 ft. long and 27 ft. high. It has an emergency spillway, diversion conduit and an adjacent earth fill dike. Based on visual inspection, records available at the site and past operational performance, the dam is judged to be in fair condition. Based on selected size and hazard classifications, the Probable Maximum Flood was selected to test the hydraulic adequacy of the spillway.

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NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

Identification Number:	CT 00209
Name:	Shenipsit Lake Dam
Town:	Vernon
County and State:	Tolland County, Connecticut
Stream:	Hockanum River
Date of Inspection:	June 13, 1978

BRIEF ASSESSMENT

The Shenipsit Lake Dam is a granite stone masonry structure 70 feet long and 27 feet high. It has an emergency spillway, diversion conduit and an adjacent earth fill dike.

Based on visual inspection, records available at the site and past operational performance, the dam is judged to be in fair condition. However, a review of the limited engineering data available reveals that there are areas of concern which must be corrected in order to assume the safety of the dam. The earth dike embankment as well as the masonry spillway have questionable structural capacity. The seepage of water into the Roosevelt Mills parking lot is of concern and as a result, we feel this condition needs to be studied further.

Based on selected size and hazard classifications, the Probable Maximum Flood (PMF) was selected to test the hydraulic adequacy of the spillway. It was determined that the spillway would pass only 16.5 percent of the peak discharge of such an event before overtopping of the dam would occur. Consequently, it is recommended that more detailed hydrologic/hydraulic studies be accomplished to refine the test flood, to determine the ability of non-overflow sections to withstand overtopping and, if appropriate, recommend alternative ways to increase the spillway capacity.

Some recommended measures to be undertaken by the owner include establishing metering points for seepage measurements, stability analysis of the earth dike and a formal warning system.

The owner should implement the recommendations and remedial measures described in Section 7 within one to two years after receipt of this Phase I Inspection Report.

Joseph F. Merluzzo
Connecticut P.E. #7639
Project Manager

Richard F. Lyon
Connecticut P.E. #8443
Project Engineer

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations and analyses involving topographic mapping, subsurface evaluations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify the need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I Inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and varity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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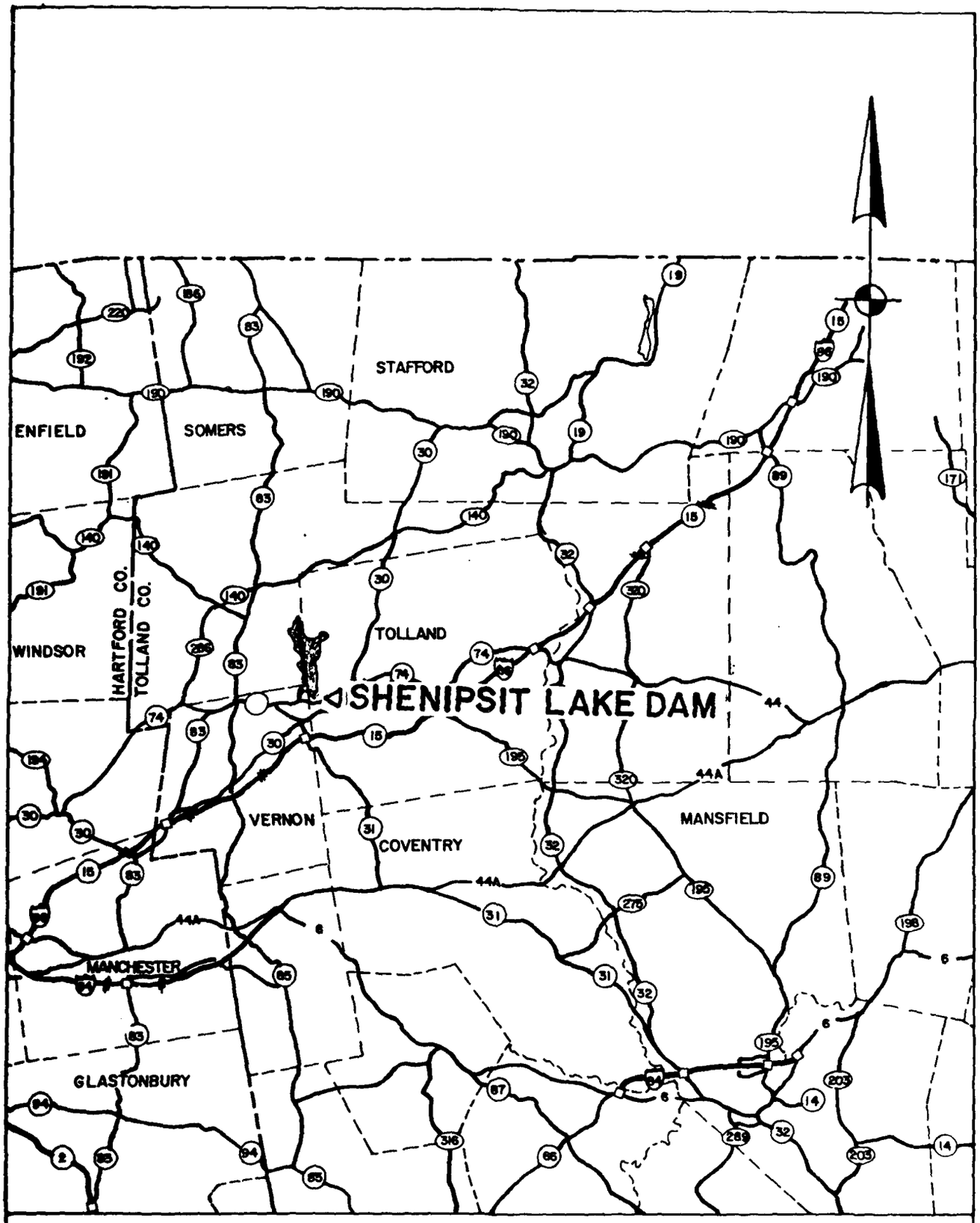
OVERVIEW PHOTO - SHENIPSIT LAKE DAM


STAFFORD
ENFIELD
SOMERS
WINDSOR
HARTFORD CO.
TOLLAND CO.
TOLLAND
SHENIPSIT LAKE DAM
VERNON
COVENTRY
MANSFIELD
MANCHESTER
GLASTONBURY
U.S. ARMY, CORPS OF ENGINEERS
NEW ENGLAND DIVISION
WALTHAM, MASS.
APPROXIMATE SCALE
SCALE OF MILES
0
10
LOCATION MAP

PHASE I INSPECTION REPORT

SHENIPSIT LAKE DAM

SECTION 1 - PROJECT INFORMATION

1.1 General

a. Authority - Public Law 92-367, August 8, 1972 authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Storch Engineers has been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed were issued to Storch Engineers under a letter of May 3, 1978 from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW33-78-C-0000 has been assigned by the Corps of Engineers for this work.

b. Purpose -

(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) Encourage and prepare the states to initiate quickly effective dam safety programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

The Rockville Water and Aqueduct Company which is owned by the Connecticut Water Service, Inc. maintains, treats and distributes water to customers in the greater Vernon area.

The Shenipsit Dam was initially constructed in 1834 with major modifications in 1903. The only construction record is a single contract drawing from the 1903 modification. The information from this drawing is reproduced on Plates 1, 2 and 3, Appendix B.

The size classification is intermediate (27 feet high and 8,700 acre feet of storage) and the hazard classification is high as per the criteria set forth in Recommended Guidelines for Safety Inspection of Dams by the Corps of Engineers. The immediate downstream area which will be affected by the dam's failure as shown on Plates 5 and 6, Appendix D, includes the industrialized portion of the Rockville section of Vernon. Industries such as Roosevelt Mills, Amerbelle and LaPointe as well as intensely developed commercial and residential sections are within the potentially inundated areas.

The spillway which is located at the south end of the lake (Appendix B, Plate 1) is a granite stone masonry structure with an upper gate house, a pump house and an adjacent earth fill dike which is faced with mortared stone retaining walls on each side. The dam is located in the Town of Vernon, Connecticut and impounds Shenipsit Lake, which is located in the Towns of Vernon, Tolland and Ellington, Connecticut. The dam is on the Hockanum River in the Hockanum River watershed.

There have been no designs or special studies done for the dam, however, the hydraulic capacity of the spillway was considered during the construction of the water treatment facility in 1968.

There is a regular staff of maintenance personnel available. The items that are regularly scheduled for maintenance are principally those items in the water treatment plant.

The person to contact for day to day operation of the dam is Kenneth Kells, Connecticut Water Service, Inc., 93 West Main Street, Clinton, Connecticut; Telephone Number: 699-8636.

1.3 Pertinent Data

a. Drainage Area - A 16.5 square mile drainage area contributes to the dam. The terrain is hilly with mixed amounts of forest, farm land and residential development.

b. Discharge at Damsite - The maximum known spillway discharge: 1,500 cfs during the flood of September, 1938.

(1) Outlet works: 30" x 45" conduit at invert elevation 484.86.

(2) Maximum known flood at damsite: 1,500 cfs.

(3) Ungated spillway capacity at maximum pool elevation: 2,300 cfs at 517.21 elevation.

(4) Gated spillway capacity at pool elevation: N/A cfs at N/A elevation.

(5) Gated spillway capacity at maximum pool elevation: N/A cfs at N/A elevation.

(6) Total spillway capacity at maximum pool elevation: 2,300 cfs at 517.21 elevation.

c. Elevation (Feet above MSL)

(1) Top of dam: 517.21

(2) Maximum pool-design surcharge: Not known

(3) Full flood-control pool: N/A

(4) Recreation pool: N/A

(5) Spillway crest: 511.21

(6) Upstream portal invert diversion tunnel: 484.86

(7) Streambed at centerline of dam: 484.86

(8) Maximum tailwater (1938 Flood): 496.77

d. Reservoir

(1) Length of maximum pool: 12,000 feet ±

(2) Length of recreation pool: N/A

(3) Length of flood-control pool: N/A

e. Storage (Acre-Feet)

(1) Recreation pool: N/A

(2) Flood-control pool: N/A

(3) Design surcharge: Not known

(4) Top of dam: 8,700 ±

f. Reservoir Surface (Acres)

(1) Top of dam: 685 ±

(2) Maximum pool: N/A

(3) Flood-control pool: N/A

(4) Recretaion pool: N/A

(5) Spillway crest: 430 ±

g. Dam (Main spillway)

(1) Type: Masonry - Gravity

(2) Length: 70' ±

(3) Height: 27' ±

(4) Top width: 4' ±

(5) Side slopes: 1:2 (on downstream face of masonry spillway)

(6) Zoning: N/A

(7) Impervious core: N/A

(8) Cutoff: unknown

(9) Grout curtain: unknown

(10) Other: N/A

h. Diversion and Regulating Tunnel

(1) Type: cast iron

(2) Length: 27.5 feet

(3) Closure: Not applicable

(4) Access: Upper and lower gate houses.

(5) Regulating facilities: Electrically operated gate

i. Spillway

(1) Type: Granite block - fixed weir

(2) Length of weir: 46 feet

(3) Crest elevation: 511.21 feet

(4) Gates: None

(5) U/S Channel: Underwater

(6) D/S Channel: Natural rock channel

(7) General: N/A

j. Regulating Outlets

Regulating outlets consist of a 30" x 45" conduit along with a 30 inch watermain that operates through a pump.

(1) Invert: 484.86

(2) Size: 30" x 45"

(3 Description: cast iron

(4) Control mechanism: electrically operated sluice gate

(5) Other: N/A

SECTION 2 - ENGINEERING DATA

2.1 Design

There is no formal design available for the dam both in terms of stability analysis or spillway capacity. At the time of construction, these methods of design were not widely used.

2.2 Construction

The years of construction for the original dam began in 1834 and it has had several modifications since then. The evaluation and repair of the retaining wall on the east dike began after the flood of 1938. The upper gate house renovation and work for the water treatment facility was completed between 1968 and 1970. Borings taken during this time show the dam to be founded on a soft, seamy mica schist. There are no construction photos available for any of the corrective work to the dam.

2.3 Operation

The operation of the dam is for the purpose of water supply. The engineer of design and construction for Connecticut Water Service, Inc. furnished a copy of the following operations plan:

1. During the winter, keep the level of Shenipsit Lake down two to three feet below the spillway crest.

2. During March or April after the ice melts, the reservoir is allowed to rise and flow over the spillway.

3. During the hurricane season, the reservoir is kept down three to four feet for increased storage capacity.

Other than the spillway, the water flow is controlled by means of various water mains and a 30" x 45" penstock tunnel. The capacities of these conduits is discussed in Section 5.

2.4 Evaluation

a. Availability - The construction drawings were readily available. Because of the age of the dam, there is no design information.

b. Adequacy - The information that was made available was only a minor factor in the assessment which was based mainly on the visual inspection, past performance history and hydrologic and hydraulic assumptions.

c. Validity - The construction drawings are accurate to the extent that the visible inspection did not reveal any new features.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

a. General - The visual inspection was conducted on June 13, 1978 by members of the engineering staff of Storch Engineers with the help of Kenneth Kells of the Connecticut Water Service, Inc. A copy of the visual check list is contained in Appendix A.

The following procedure was used for the inspection:

1. Examination of the granite stone masonry dam for shifting, leaks and loose grout or stones.
2. Measurement of seepage discharges using calibrated containers and a stopwatch.
3. Inspection of the dike adjacent to the spillway for seepage, cracks, slippage or movement.
4. Measurement of the temperature of seepage water, water in the reservoir and water downstream.
5. Examination survey of the downstream area for consideration of possible failure effects.
6. Photographing the general view of the dam and its appurtenant structures and other areas that received attention during the inspection.

Before the inspection, the contract plans and other information that was available was compiled and studied. A compact sketch of the main structures was used for orientation during the inspection (Appendix B, Plate 1).

In general, the overall appearance and conditon of the dam and appurtenant structures is fair.

b. Dam - The body of the dam is made up of granite block stone masonry with mortared joints. There were several minor leaks from the joints in the face of the spillway. The condition of the mortar beneath the surface could not be determined. The relationship of the dam to the adjacent rock surfaces showed no evidence of slippage or movement. Measurement of the seepage discharge from the face of the dam was approximately 5 to 6 gallons/min. Photographs taken in October, 1976 which were made available by the owner showed the area in back of the spillway at a lowered water surface elevation. The photographs did not indicate areas of distress.

c. Appurtenant Structures - The upper gate house was reconditioned in 1968 in conjunction with the construction of the water treatment plant. Our inspection showed the structure to be in good condition except for water that was leaking into the intake well through the joints in the granite blocks. It appears that the chemical content of the

water in the reservoir causes deterioration of the mortar joints. The replacement of the sluice gates only three years after their installation in 1968 and the condition of the bolts as shown in Photo 6, Appendix C, are further evidence of the deteriorating effect of the water. The penstock pipe was underwater. Maintenance personnel reported no evidence of damage when it was last observed.

The earth fill dike is faced with granite retaining walls. During the inspection, seepage was observed at the southern corner of the dike which dropped into the parking lot at Roosevelt Mills (Appendix C, Photos 7 and 8). The top of the dike is overgrown with trees and brush. The retaining wall which faces the downstream side of the dike consists of dry rubble masonry.

d. Reservoir Area - The upstream sides of the reservoir appear to be in a natural state with no visible signs of erosion or sloughing.

e. Downstream Channel - The spillway and downstream channel are cut into the ledge and are generally in good condition. The trees which overhang the channel preclude general observation of the channel slope.

3.2 Evaluation

Of the items observed, most of the negative aspects were associated with the zones that showed seepage. Although the dam did not exhibit areas of distress, there is some question with regard to its structural capacity because of the unknown conditions within the dam.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

The responsibility for maintenance of the dam is with the Rockville Water and Aqueduct Company, with engineering design and construction assistance from its parent company, Connecticut Water Service, Inc. The maintenance staff is headquartered at the water treatment facility adjacent to the dam site. These staff personnel operate and maintain the valves and equipment for the water treatment facility and perform regular inspections of the dam. A written emergency procedure for periods of flooding or threatened flooding is available. A copy of this procedure is contained in the Appendix.

4.2 Maintenance of the Dam

The maintenance of this dam centers around the repointing of the grout between the granite stone blocks. The reservoir is periodically drawn down so that the rear face of the spillway can be observed and repaired.

4.3 Maintenance of Operating Facilities

The operating facilities consist of the sluice gates and valves and piping which are part of the water treatment facility. The hydraulic capacity of the piping is discussed in Section 5.

4.4 Description of Warning System

The warning system as described in Appendix B is not coordinated with state and/or local officials.

4.5 Evaluation

The maintenance of the operating equipment seems adequate, however, the equipment's operation will not significantly affect the hydraulic capacity of the spillway.

SECTION 5 - HYDRAULIC/HYDROLOGY

5.1 Evaluations of Features

a. Design Data - The 46 foot long spillway, 30 inch by 45 inch diversion conduit and various water supply pipes are the only means of transmitting water past the dam.

Using the guide curves supplied by the Corps of Engineers (rolling terrain), the PMF inflow into the reservoir is 24,750 cfs and the routed outflow is 13,870 cfs. The pond elevation at the PMF is 523.5 or 6.29 feet over the top of the dam. The hydraulic capacity of the spillway without overtopping appears to be 2,300 cfs or about 16.5 percent of the PMF, (the test flood adopted for this evaluation).

b. Experience Data - The Shenipsit Lake Dam has experienced the floods of November, 1927; March, 1936; September, 1938 (maximum) and August and October, 1955. During the flood of September, 1938, the depth of flow over the spillway was 4.23 feet and the discharge was 1,500 cfs. According to observations at the time, the spillway passed the flow, however, the pond elevation was very near the top of the dam. Subsequent to the 1938 flood, a concrete wall approximately three feet high was constructed to increase the maximum depth of flow over the spillway to six feet before the dam is overtopped.

c. Visual Observations - The spillway at the time of the inspection was in fair condition with water seeping out of the joints in many places (Appendix C).

Approximately 300 feet downstream, the river passes under Roosevelt Mills in a conduit approximately 25 feet wide by 5 feet high. This type of containment and channelization is found throughout the river reach in the Rockville section of Vernon, as many mills once used the river for power.

The 30 inch by 45 inch diversion conduit is in good operating condition and is used to draw down the lake in an emergency.

d. Overtopping Potential - Our calculations indicate that the PMF will overtop the dam by 6.29 feet.

SECTION 6 - EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations - There are routine inspections performed periodically by the resident staff. During these inspections they observe the condition of the dam, retaining walls, upper and lower gate houses, banks of the upstream and downstream areas. The results of the visual inspection for this report showed that there was a considerable amount of seepage leaks and leaching of mortar between masonry stones. This creates some doubt about the dam's reliability.

b. Design and Construction Data - The only design and construction data available was the original contract drawing and other drawings for the period of reconstruction of the upper gate house in 1968.

c. Operating Records - The water level of the Shenipsit Lake is monitored periodically at the retaining wall near the spillway by a stationary wooden gauge.

d. Post Construction Changes - The following changes to the Shenipsit Lake Dam facility have been noted since the completion of the 1903 modifications:

1. Seepage through the stone construction joints of the dam body and retaining wall near the parking area and in the well of the upper gate house (Appendix C).

2. Leaching and the weathering of the cement mortar in the joints of the stone masonry (Appendix C, Photo 3).

3. Reconstruction of the upper gate house.

4. Addition of a 3± foot high concrete wall to the top of the existing granite masonry (Appendix C, Photo 1).

e. Seismic Stability - The dam is located in Seismic Zone No. 1 and in accordance with recommended Phase I guidelines (Reference 2) does not warrant seismic analysis.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition - After study of the design data, the operating records, the post construction changes, the results of this inspection and the calculations of the probable maximum flood discharges, the conclusion is that the general condition of the dam and its appurtenant structures is fair. The capacity of the spillway is such that only 16.5 percent of the probable maximum flood discharge can be passed. The total seepage through the dam body and the retaining wall was measured to be approximately 8 to 10 gallons/min. However, there are no visible signs of any movements or distress of the dam.

b. Adequacy of Information - The information available is such that the assessment of the safety of the dam was based primarily on the visual inspection results and the past operational performance of the structures.

c. Urgency - It is considered that the recommendations and remedial measures in the following paragraphs be implemented within one to two years after receipt of this Phase I Inspection Report.

d. Need for Additional Investigation - Taking into account the observations of this report, further investigation of the dam by a qualified engineering firm should be performed particularly the study of seepage, underground water pressure and properties of stone masonry.

7.2 Recommendations

In view of the concern for the safety of the dam and the lack of the engineering data for evaluating its condition, it is recommended that the following measures be undertaken by the owner:

1. Upstream and downstream instrumentation for the dam should be provided to monitor the dam behavior. This instrumentation should include the metering of the upstream and downstream water level, daily; seepage discharges through the body of the dam and the retaining walls, monthly and the seepage pressure in the base of the dam by piezometers, monthly.
2. The exact geometric configuration of the dam, the elevation of its base, the mechanical properties of the stone masonry and the rock in its foundation should be determined for a more exact assessment of its structural intergrity.

3. A stability analysis of the earth dike should be completed to determine its factor of safety.

4. An inspection program should be developed for the periods of the highest and lowest water levels in the reservoir to assure that all features of the dam are continually maintained.

5. A study should be completed to determine methods of increasing the spillway capacity.

7.3 Remedial Measures

The following items should be attended to as early as practical:

a. Alternatives - Not applicable.

b. O & M Maintenance and Procedures -

1. The seepage through the stone masonry and the empty joints between the stones of the dam, the well of the upper gate house and the retaining walls should be repaired.

2. An operational and maintenance manual should be developed.

3. The warning system for flood conditions (Appendix B) should be reviewed and coordinated with state and/or local officials.

APPENDIX A

VISUAL INSPECTION CHECK LIST A-1 to A-8

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Shenipsit Dam

DATE 6-13-78

TIME 8:30 - 12:00

WEATHER Cloudy

W.S. ELEV. 511.0 U.S. ____ DN.S.

PARTY:

1. Richard Lyon
2. Miron Petrovsky
3. Gary Giroux
4. John Schearer
5. John Pozzato
6. Kenneth Kells (Conn Water Co.)
7. ____
8. ____
9. ____
10. ____

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

Upstream Temperature 78° F

Downstream Temperature 78° F

PERIODIC INSPECTION CHECK LIST

PROJECT Shenipsit Dam DATE 6-13-78

PROJECT FEATURE _____ NAME R. Lyon

DISCIPLINE _____ NAME M. Petrovksy

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT	
Crest Elevation	Good condition - remortared
Current Pool Elevation	Good condition
Maximum Impoundment to Date	Concrete in good condition - retainage wall added
Surface Cracks	Some cracks observed in mortar joints
Pavement Condition	N/A
Movement or Settlement of Crest	None observed
Lateral Movement	None observed
Vertical Alignment	Good condition
Horizontal Alignment	Good condition
Condition at Abutment and at Concrete Structures	Solid with some leaking through mortar joints
Indications of Movement of Structural Items on Slopes	None
Trespassing on Slopes	Not permitted
Sloughing or Erosion of Slopes or Abutments	N/A
Rock Slope Protection - Riprap Failures	N/A
Unusual Movement or Cracking at or near Toes	None observed
Unusual Embankment or Downstream Seepage	Seepage noted in areas shown on attached sheets
Piping or Boils	None observed
Foundation Drainage Features	None
Toe Drains	None
[illegible]	None

PERIODIC INSPECTION CHECK LIST

PROJECT Shenipsit Dam DATE 6-13-78

PROJECT FEATURE _____ NAME M. Petrovsky

DISCIPLINE _____ NAME J. Pozzato

AREA EVALUATED	CONDITION
DIKE EMBANKMENT	
Crest Elevation	Good condition
Current Pool Elevation	Good condition
Maximum Impoundment to Date	Adjusted since 1938 Flood
Surface Cracks	None observed
Pavement Condition	N/A
Movement or Settlement of Crest	Not apparent
Lateral Movement	Good condition
Vertical Alignment	Good condition
Horizontal Alignment	Wavy alignment
Condition at Abutment and at Concrete Structures	Good
Indications of Movement of Structural Items on Slopes	Not apparent
Trespassing on Slopes	Not allowed (some observed)
Sloughing or Erosion of Slopes or Abutments	Not observed
Rock Slope Protection - Riprap Failures	Fair condition with some loose stones and wavy alignment observed
Unusual Movement or Cracking at or near Toes	None observed
Unusual Embankment or Downstream Seepage	Seepage observed at toe of embankment - see attached sheets
Piping or Boils	Not observed
Foundation Drainage Features	None
Toe Drains	None

Wall

A-3

PERIODIC INSPECTION CHECK LIST

PROJECT Shenipsit Dam DATE 6-13-78

PROJECT FEATURE _____ NAME G. Giroux

DISCIPLINE _____ NAME J. Schearer

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Chan[illegible]	
Slope Conditions	
Bottom Conditions	Underwater
Rock Slides or Falls	
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	
Condition of ~~Concrete~~ Granite Blocks	Leaking at several random locations in the face wall
Stop Logs and Slots	Open condition at all times

PERIODIC INSPECTION CHECK LIST

PROJECT Shenipsit Dam DATE 6-13-78

PROJECT FEATURE _____ NAME R. Lyon

DISCIPLINE _____ NAME G. Giroux

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	
General Condition	Good condition
Condition of Joints	Good condition
Spalling	N/A
Visible Reinforcing	N/A
Rusting or Staining of Concrete	N/A
Any Seepage or Efflorescence	Very little observed
Joint Alignment	Good
Unusual Seepage or Leaks in Gate Chamber	Underwater, leaking at water surface observed
Cracks	N/A
Rusting or Corrosion of Steel	N/A
b. Mechanical and Electrical	
Air Vents	None
Float Wells	
Crane Hoist	
Elevator	
Hydraulic System	
Service Gates	Replaced in 1971 (corrosion problem) underwater could not be observed
Emergency Gates	
Lightning Protection System	None
Emergency Power System	None
Wiring and Lighting System in	None

PERIODIC INSPECTION CHECK LIST

PROJECT Shenipsit Dam

DATE 6-13-78

PROJECT FEATURE

NAME M. Petrovsky

DISCIPLINE

NAME G. Giroux

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	
General Condition of Concrete	
Rust or Staining on Concrete	
Spalling	
Erosion or Cavitation	Underwater - could not observe
Cracking	
Alignment of Monoliths	
Alignment of Joints	
Numbering of Monoliths	

PERIODIC INSPECTION CHECK LIST

PROJECT Shenipsit Dam DATE 6-13-78

PROJECT FEATURE NAME J. Schearer

DISCIPLINE NAME J. Pozzato

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
General Condition of Ledge ~~XXXXXXX~~	Good
Rust or Staining	None observed
Spalling	N/A
Erosion or Cavitation	Not observed
Visible Reinforcing	N/A
Any Seepage or Efflorescence	Very little observed
Condition at Joints	Some cracked mortar observed
Drain holes	None
Channel	
Loose Rock or Trees Overhanging Channel	Many trees overhang channel
Condition of Discharge Channel	Good condition

PERIODIC INSPECTION CHECK LIST

PROJECT Shenipsit Dam DATE 6-13-78

PROJECT FEATURE _____ NAME R. Lyon

DISCIPLINE _____ NAME M. Petrovsky

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	
Loose Rock Overhanging Channel	Underwater
Trees Overhanging Channel	
Floor of Approach Channel	
b. Weir and Training Walls	
General Condition of ~~Concrete~~ Granite	Fair
Rust or Staining	N/A
Spalling	N/A
Any Visible Reinforcing	N/A
Any Seepage or Efflorescence	Seepage measured - see attached sheets
~~Drain Holes~~	None
c. Discharge Channel	Same as for diversion conduit
General Condition	Good
Loose Rock Overhanging Channel	Rock in firm condition
Trees Overhanging Channel	Many observed
Floor of Channel	Difficult to observe - underwater
Other Obstructions	Several mills and dams downstream which could be effected by heavy rains

APPENDIX B

All references except Nos. 9, 10, 11 and 12 are located at Connecticut Water Service, Inc., 93 West Main Street, Clinton, Connecticut.

1. "Plan and Sections of Shenipsit Lake Dam". Contract Drawing No. 2273 H. Rockville Water and Aqueduct Company; Rockville, Connecticut; September 25, 1978.

2. "Plan and Sections of Water Treatment Plant of Shenipsit Lake Dam". Contract Drawings Nos. 44736, 44739 and 43806. Rockville Water and Aqueduct Company; Rockville, Connecticut; August, 1968.

3. View of Upstream Side of Shenipsit Lake Dam. Three Photos; Rockville Water and Aqueduct Company; Rockville, Connecticut; October, 1976.

4. "Hurricane Floods of September, 1938" by Carl G. Paulsen; U.S. Department of the Interior; Geological Survey; Water-Supply Paper 867; Washington, 1940, p. 202 and Isohyetal Map of Total Precipitation, in inches; September 17-21, 1938.

5. Boring Logs for Holes Nos. 1 and 4 of Water Treatment Plant; Rockville Water and Aqueduct Company; Rockville, Connecticut; March, 1968.

6. Form of Visual Inspection Check List for Dams; Rockville Water and Aqueduct Company; Rockville, Connecticut.

7. "Shenipsit Lake Dam". Operating Procedure; Rockville Water and Aqueduct Company; Rockville, Connecticut; April 30, 1977.

8. "Inspection of New Treatment Facilities"; Rockville Water and Aqueduct Company; Rockville, Connecticut; March, 1974.

9. Recommended Guidelines for Safety Inspection of Dams. Department of the Army; Office of the Chief of Engineers; Washington, D.C.; November, 1976.

10. Guide Curves for the Probable Maximum Flood (PMF) for Regions of New England based on past Corps of Engineers' Studies; March, 1978.

11. "Preliminary Guidance for Estimating Maximum Probable Discharges in Phase I Dam Safety Investigations". New England Division; Corps of Engineers; March, 1978.

12. Rule of Thumb. Guidance for Estimating Downstream Dam Failure Hydrogrphs; Corps of Engineers; April, 1978.

INFORMATION FROM CONNECTICUT WATER SERVICE, INCORPORATED

EMERGENCY PROCEDURES

FLOODING OR THREATENED FLOODING

When the weather or weather forecast indicates a potential for flooding, the following procedures shall be initiated by the Division Manager and maintained throughout the flooding or threatened flooding period. These procedures apply to well supplies as well as reservoir supplies and to all other company facilities.

1. Alert sufficient men and officers to stand-by status so available when needed.
2. Maintain a log of incidents, actions taken and other pertinent data.
3. Raise or be prepared to raise the chlorine dosage and residual. Double check chlorine inventory and get more or relocate excesses to needed stations if necessary, can discontinue polyphosphate, caustic soda, fluoride, etc. if they affect your ability to chlorinate adquately.
4. Check inlet screens more frequently to make sure not plugged or damaged.
5. Open blowoffs and drop reservoir levels where applicable. Be careful that opened blowoffs don't aggravate a flooding or erosion problem downstream.
6. Double check spillways to make sure clear of all debris and other obstacles.

7. Check drainageway upstream and downstream from our source to make sure that all culverts, bridges, narrow channels, etc. are clear of obstructions. The upstream check is to prevent temporary log jamming or culvert blocking that might later be released and cause swamping of the source. The downstream check is to prevent backwater flooding. Any potential obstructions noted shall be reported to the state, town highway or other responsible official. If unavailable or no action is taken, the D.M. shall arrange for its removal if the flood threat is serious.

An accurate and current watershed map must be available to aid in selecting sites to check.

8. Sandbag materials should be arranged for prior to actual usage when suppliers are available. Life jackets should be available for men working in or over flood waters.

9. Sea serpents and other oil containment facilities should be arranged for in case of vehicular or non-vehicular oil spills on watersheds. A list of pollution control companies should be available with names, addresses, telephone numbers and other pertinent data. (see catalog file: Oil Spill Cleanup)

10. Report any oil spill to the State Department of Environmental Protection, Telephone No: 566-3338, Hartford, during normal office hours. At other hours, call State Police.
11. After heavy winds or heavy rainfall, but before flooding, double check drainageways, spillways culverts and bridge again. Check entire dam for beginnings of possible washout. If any questionable areas, repair or contact Engineering Department for immediate inspection.
12. Check all facilities for effects of erosion or other water damage. Include elevated storage tanks, standpipes, concrete basins, diversion works, wells, pumping stations, dam, dikes, offices, storage sheds and storage areas. Take the necessary corrective or precautionary measures to prevent or minimize loss. For structures like elevated storage tanks and pumping stations, pay particular attention to erosion near the foundations.
13. Where necessary, get power company to cut off power to stations subject to flooding. Remove chemicals, especially fluroide and chlorine, to prevent safety hazards when entering building later.
14. When high water occurs, maintain a watch at the sources, sandbagging where necessary to contain overflow in spillway or other location safe from serious erosion. Check downstream of dam on dam

face and below, for active or potential water boils and sandbag around them as needed.

15. Note highwater marks, get pictures if possible, to aid in future design or construction. Include potential sites such as Ryan Diversion, Meshaddock Brook, Kupchunas, Lead Mine Brook, etc. . .

16. Where unusually high flow over the spillway of one of our reservoirs may affect downstream flooding, set up a reporting system with the local Civil Defense, police, fire or other responsible agency and give them data on flow over the spillway. This may aid them in deciding when to evacuate downstream dwellings.

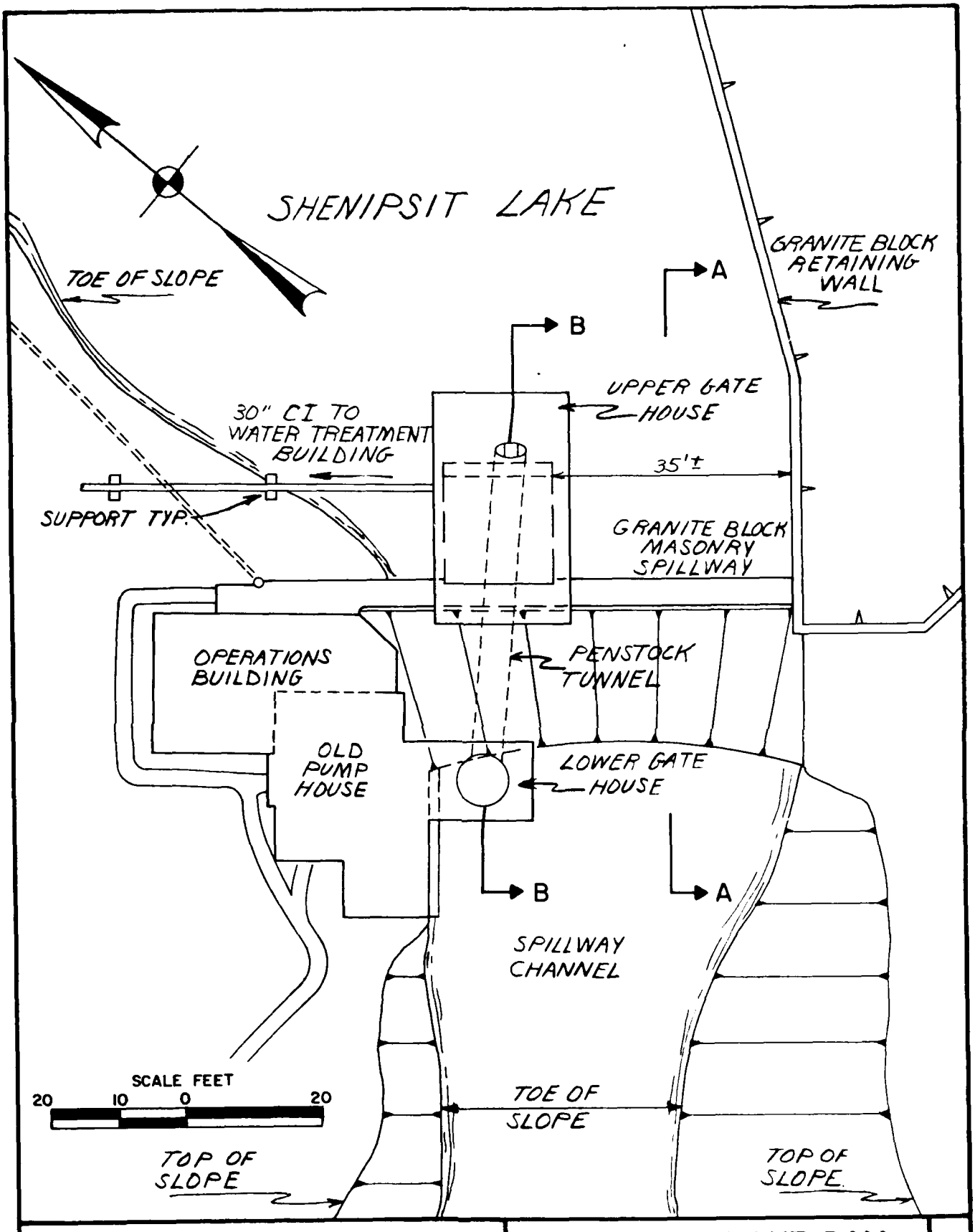
17. Get from these local agencies, reports on actual or potential road or bridge washouts and be prepared to shut down sections of mains that are affected. Valve boxes should be located well in advance and checked to see that rod will operate the valve.

18. If any dam shows signs of failing, be prepared to notify downstream residents that may be affected. The Engineering Department will prepare a map showing potential flood areas in case a dam fails. Although the primary method of damage control shall be proper

design, construction and maintenance of all dams, failure must be considered a possibility because of changing runoff patterns and unpredictable extremely heavy rainfall such as during a hurricane.

19. After the flooding, restore each station and source to normal service as soon as practical. Expect high water usuage from people cleaning up damage such as hosing down flooded basements, etc. Dry out electrical facilities and where necessary, get Engienering or electrical contractor to double check facilities before running.

20. Prepare resume of activities, results, special problems, needed improvements to prevent loss or make job easier or safer next time.

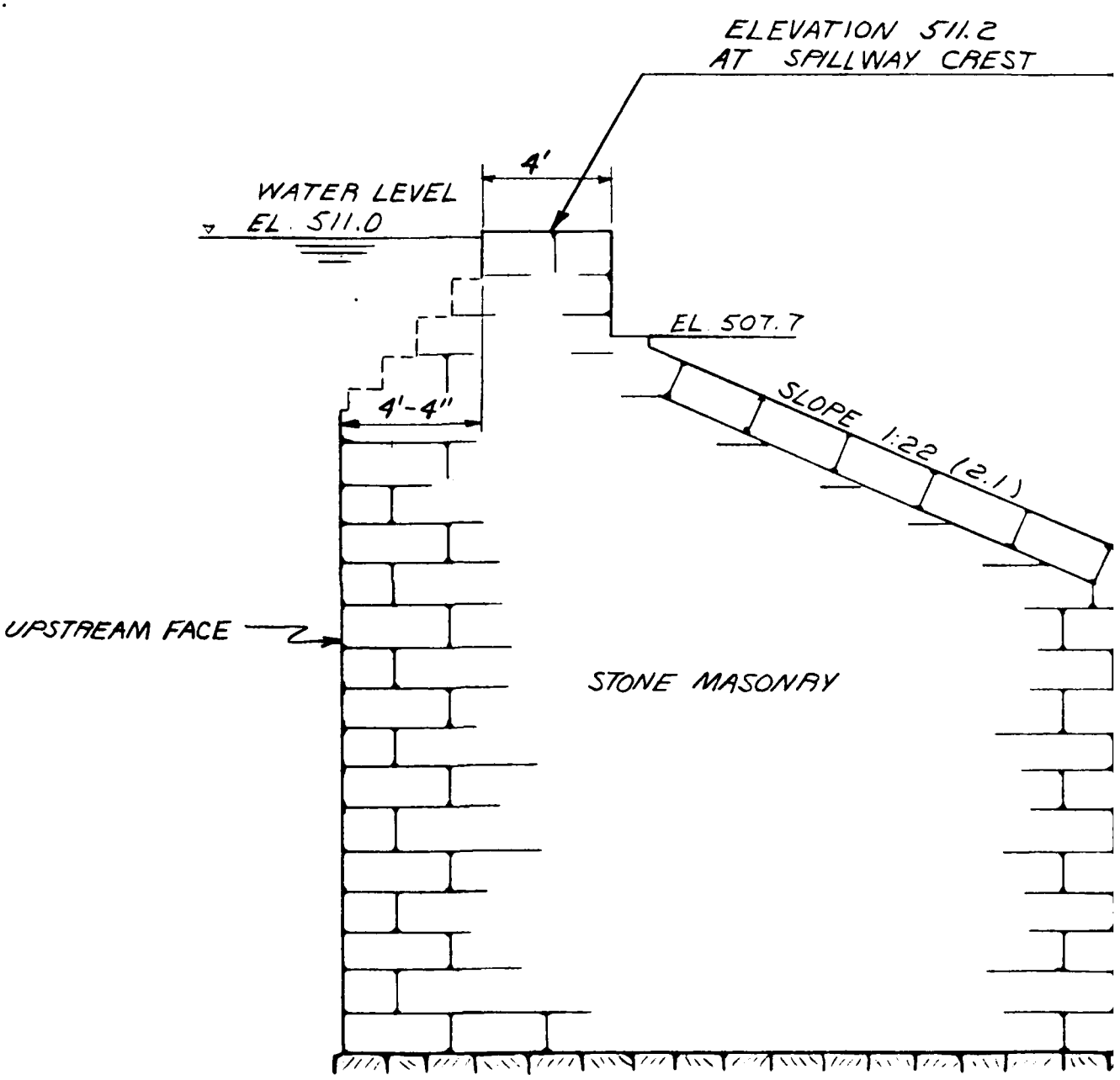


U.S. ARMY, CORPS OF ENGINEERS
NEW ENGLAND DIVISION
WALTHAM, MASS.

SHENIPSIT LAKE DAM

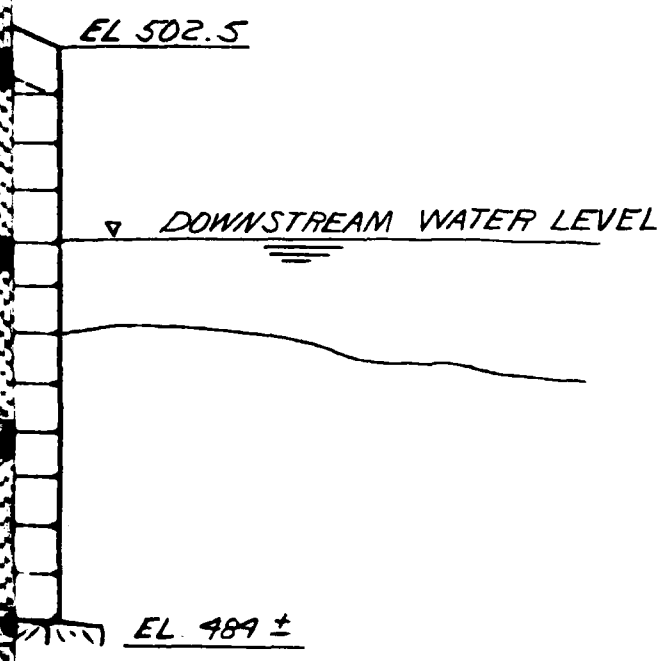
GENERAL PLAN

PLATE-1



SECTION A-A

Not to Scale



NOTE:
INFORMATION TAKEN FROM DRAWINGS SUPPLIED BY CONN. WATER INC.

PLATE-

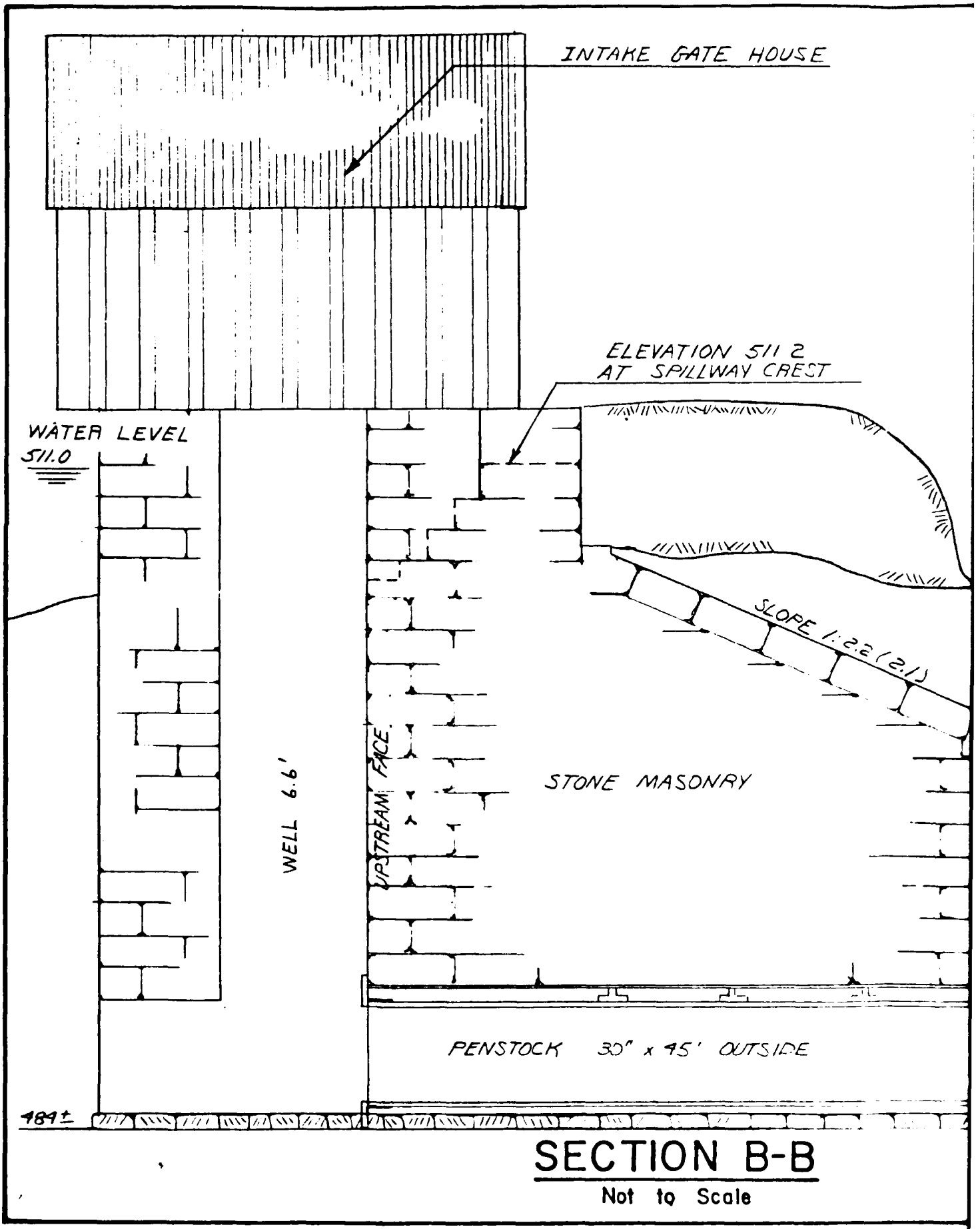
STORCH ENGINEERS WETHERSFIELD, CONNECTICUT	U.S. ARMY ENGINEER DIV. NEW ENGLA CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

SHENIPSIT LAKE DAM

HOCKANUM RIVER CONNECTICUT

			SCALE: AS SHOWN
			DATE : AUGUST 1978



SECTION B-B

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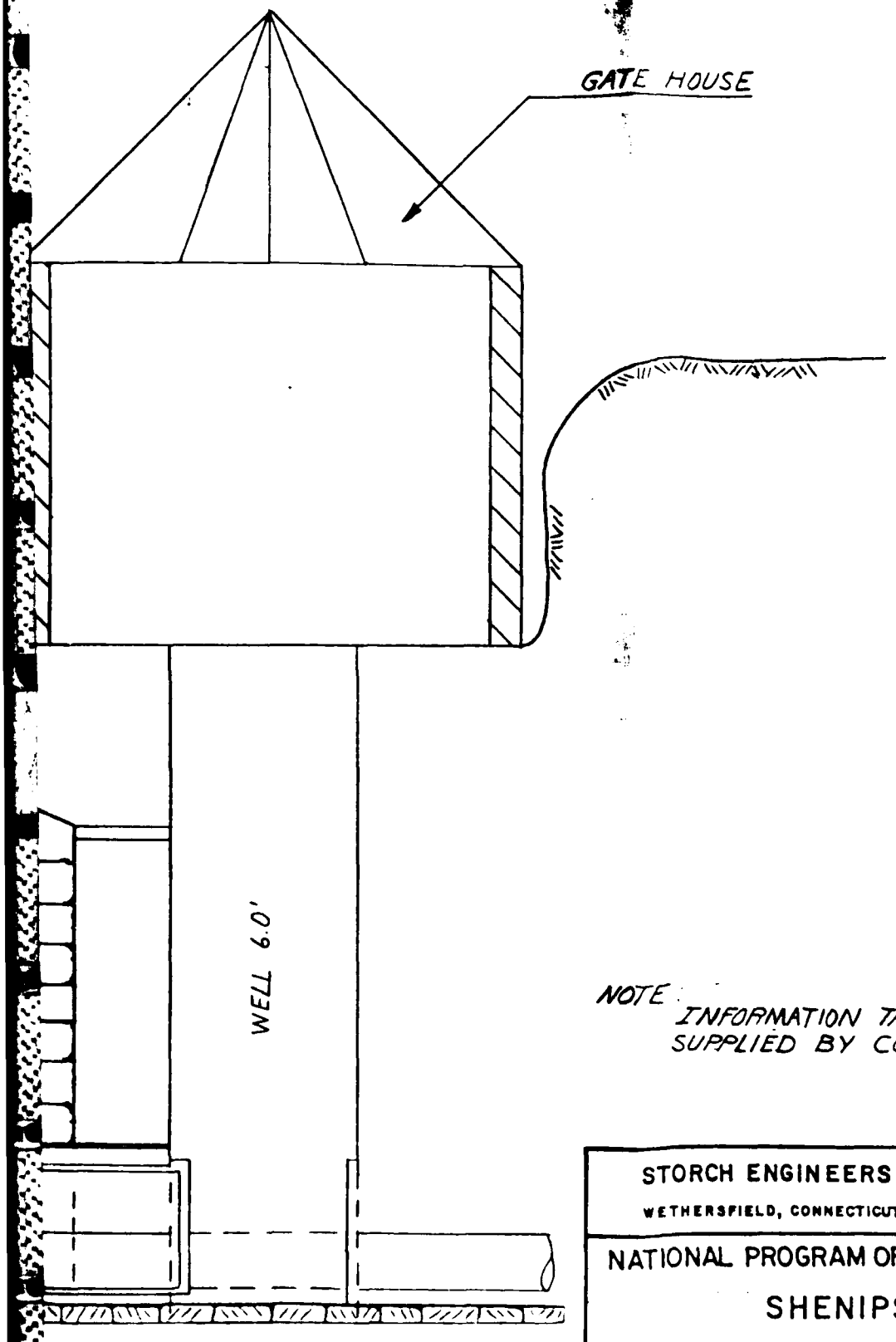


NOTE:
INFORMATION TAKEN FROM DRAWINGS SUPPLIED BY CONN WATER INC.

PLATE-3

STORCH ENGINEERS WETHERSFIELD, CONNECTICUT	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

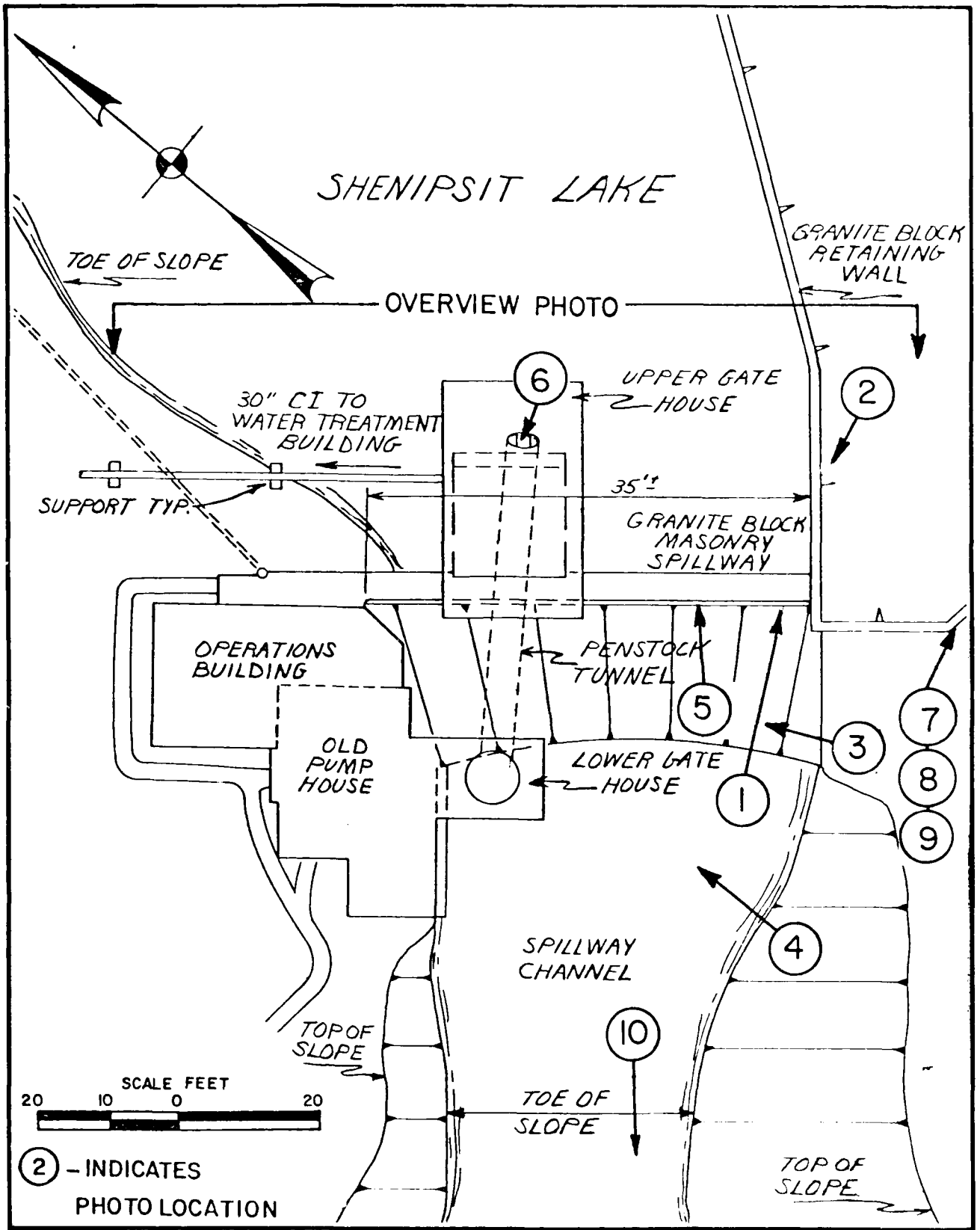
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

SHENIPSIT LAKE DAM

HOCKANUM RIVER — CONNECTICUT

			SCALE: AS SHOWN
			DATE : AUGUST 1978

APPENDIX C



U.S. ARMY, CORPS OF ENGINEERS
NEW ENGLAND DIVISION
WALTHAM, MASS.

SHENIPSIT LAKE DAM

PHOTO LOCATION PLAN

PLATE-4

PHOTO 1

UPSTREAM EMBANKMENT RETAINING WALL

PHOTO 2

UPSTREAM FACE OF DAM AND ADJACENT EARTH EMBANKMENT WITH RETAINING WALL

PHOTO 3

SPILLWAY - UPPER GATE HOUSE

PHOTO 4

SPILLWAY - LOWER GATE HOUSE

PHOTO 5

SPILLWAY - LEAK

PHOTO 6

UPPER GATE HOUSE - WETWELL

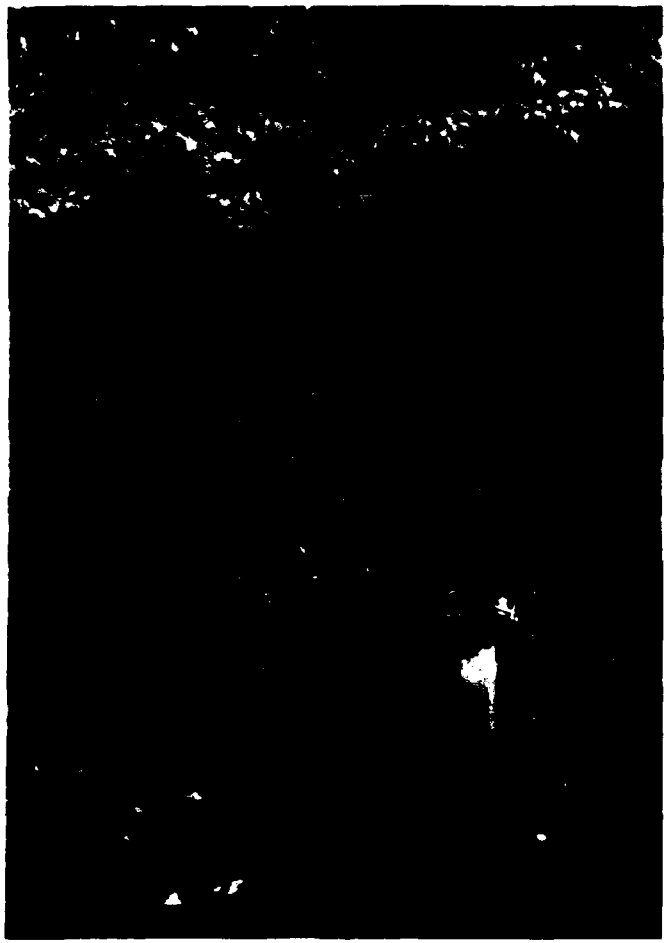


PHOTO 7
DOWNSTREAM FACE OF DAM - SEEPAGE

PHOTO 8
DOWNSTREAM FACE OF DAM - SEEPAGE

PHOTO 9

DOWNSTREAM FACE OF DAM - SEEPAGE

PHOTO 10

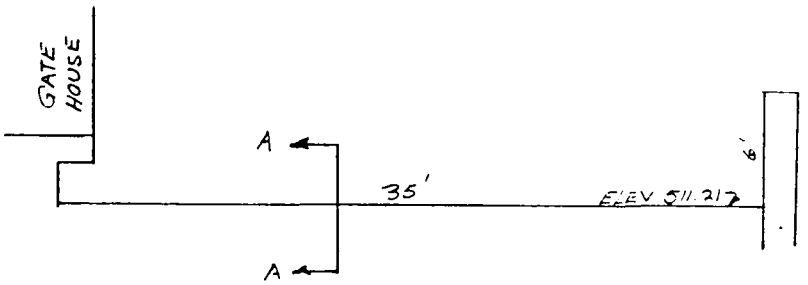
DAM 200'± DOWNSTREAM

APPENDIX D

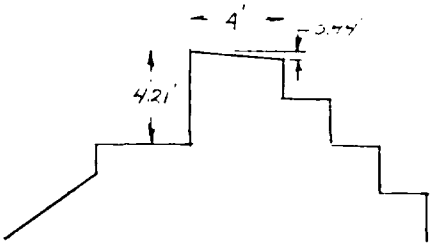
STORCH ENGINEERS
Engineers - Landscape Architects
Planners - Environmental Consultants

SHENIPSIT LAKE DAM - STAGE DISCHARGE

SPILLWAY



$Q = CLH^{3/2}$



SECTION A-A

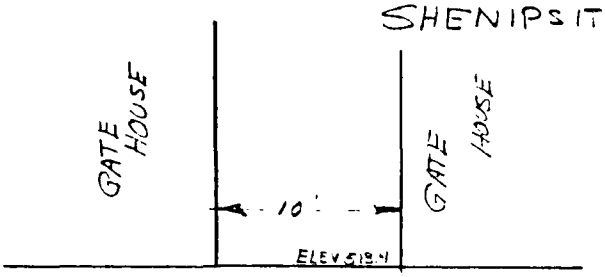
H	C	Q	Elev
0.0	0.0	0.0	511.21
1.0	3.47	121.5	512.21
1.5	3.46	222.5	512.71
2.0	3.41	337.5	513.21
2.5	3.35	463.5	513.71
3.0	3.32	603.8	514.21
3.5	3.33	763.2	514.71
4.0	3.37	943.6	515.21
4.5	3.41	1139.3	515.71
5.0	3.46	1353.9	516.21
6.0	3.33	1713.0	517.21
7.0	3.35	2172.0	518.21
8.0	3.36	2661.0	519.21
10.0	3.40	3763.0	521.21
12.0	3.42	4976.0	523.21
14.0	3.46	6344.0	525.21
16.0	3.49	7818.0	527.21
18.0	3.52	9408.0	529.21

$P = 27.0'$

$C = 3.235 + \frac{1}{60H - .56} - .429\frac{H}{P}$

SHENIPSIT LAKE DAM

STAGE DISCHARGE over DAM SECTION
(BETWEEN GATE HOUSES)
SAME SECTION AS SPILLWAY



$$Q = C L H^{3/2}$$

H	C	Q	Elev
0.0	0.0	0.0	513.4
1.0	3.47	34.7	514.4
1.5	3.46	63.6	514.9
2.0	3.41	96.4	515.4
2.5	3.35	132.0	515.9
3.0	3.32	173.0	516.4
3.5	3.33	218.0	516.9
4.0	3.37	270.0	517.4
4.5	3.41	325.0	517.9
5.0	3.46	387.0	518.4
6.0	3.33	489.0	519.4
7.0	3.35	620.0	520.4
8.0	3.36	760.0	521.4
10.0	3.40	1075.0	523.4
12.0	3.42	1422.0	525.4
14.0	3.46	1812.0	527.4
16.0	3.52	2253.0	529.4

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SHENIPSIT LAKE DAM
STAGE DISCHARGE

From STANDARD DWG NO. ES156 SH. 1 of 10 SCS
L = 150'

Q	dx	$V^2/2g$	H	ELEV
150	.65	.036	.686	517.9
300	.93	.072	1.002	518.2
600	1.33	.135	1.465	518.7
900	1.65	.195	1.845	519.1
1500	2.2	.3	2.5	519.7
3000	3.15	.55	3.7	520.9
6000	4.66	1.0	5.66	522.9
9000	5.85	1.3	7.15	524.4
15000	7.8	1.85	9.65	526.9
18000	8.7	2.15	10.85	528.1

STAGE DISCHARGE - SLUICE GATE

$Q = CA\sqrt{2g\,\Delta H}$

ΔH	C	Q	ELEV.
16	.806	242	511.21
20	.806	271	516 21
24	.806	297	520 21
28	.806	321	524 21
32	.806	343	528.21
36	.806	364	532.21

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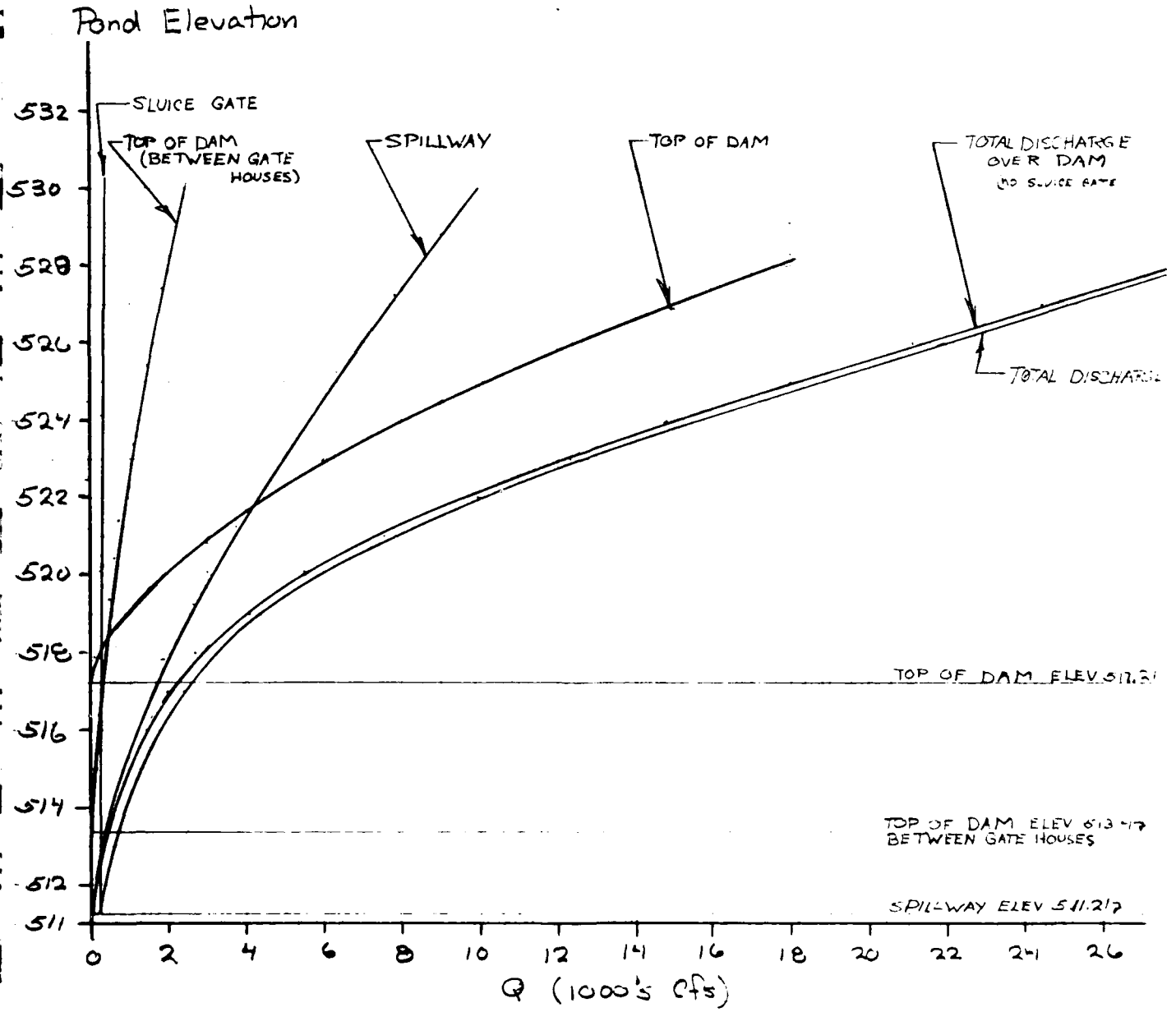
SHENIPSIT LAKE DAM
STAGE DISCHARGE



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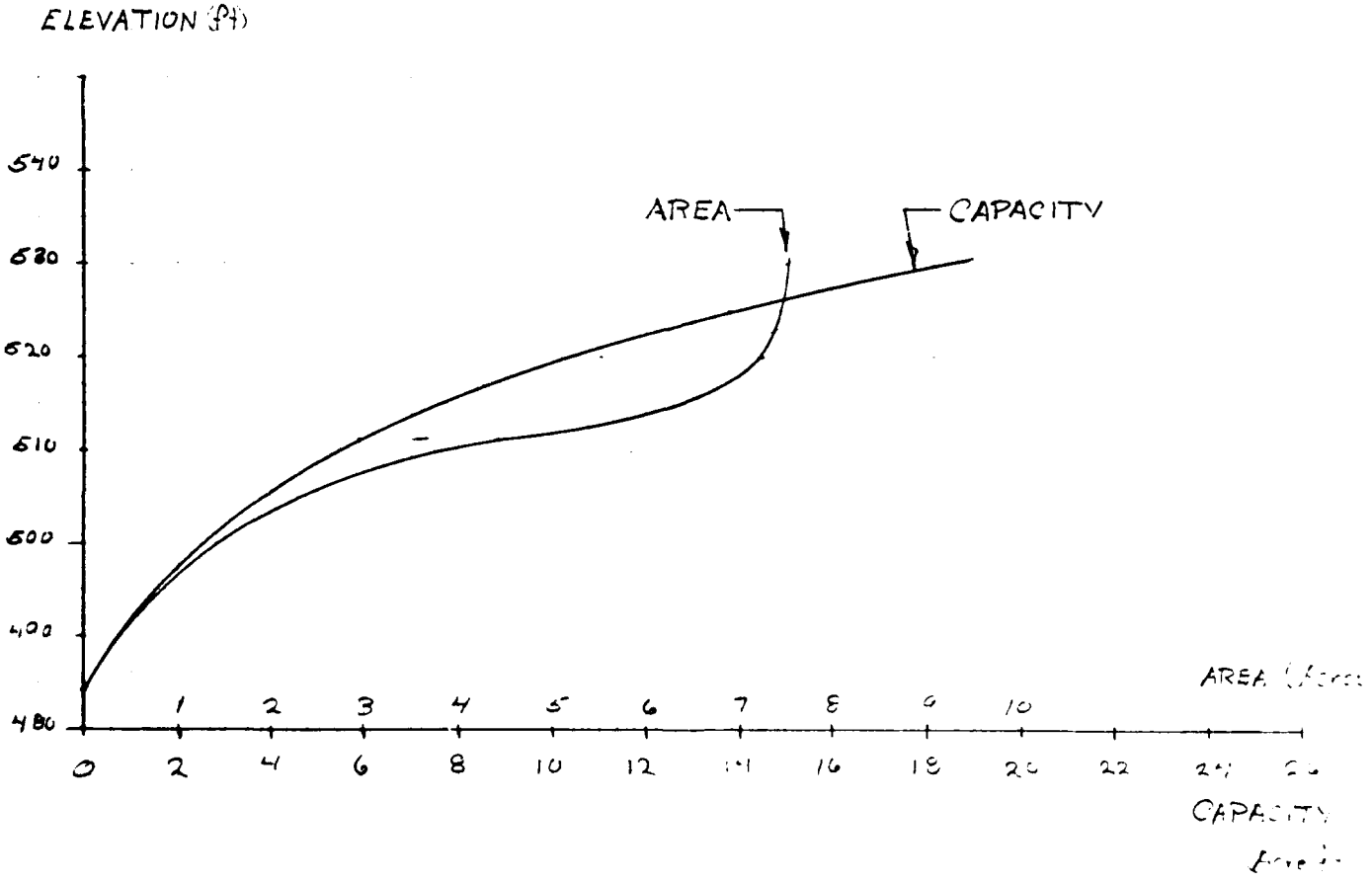
SHENIPSIT LAKE DAM
AREA - CAPACITY CURVES

ELEV.	DEPTH	AREA	AVG AREA	VOL.	Σ VOL (Acre-ft)
484.21		0.0			0.0
	27		220.0	5950	
511.21		440			5950
	8.79		582.5	5120	
520		725			11,070
	10		737.6	7375	
530		750			18,445



SHENIPSIT LAKE DAM
DETERMINATION OF SDF & PMF

Drainage Area - 16.5 SQMI

Inflow (Ref. 11) 1500 cfs/SQMI

PMF = 16.5 × 1500 = 24,750 cfs

Determine the effect of surcharge storage on Maximum Probable Discharges (Ref.).

① Q_{P1} = 24,750 cfs
②a. H_1 = 526.85 (Elev)
b. $STOR_1$ = 10.28"
c. $Q_{P2} = Q_{P1}(1 - STOR_1/19) = 24750\,(1 - 10.28/19) = 11354$ cfs
③a. H_2 = 522.5
$STOR_2$ = 6.42"
$STOR_A$ = 8.35"
$Q_{P2} = 24750(1 - 8.35/19) = 13870$ cfs
H_3 = 23.4

PMF = 13870 cfs

Capacity of Spillway when pond elevation is @ top of the dam

Q = 2600 cfs or 18.7 % of PMF

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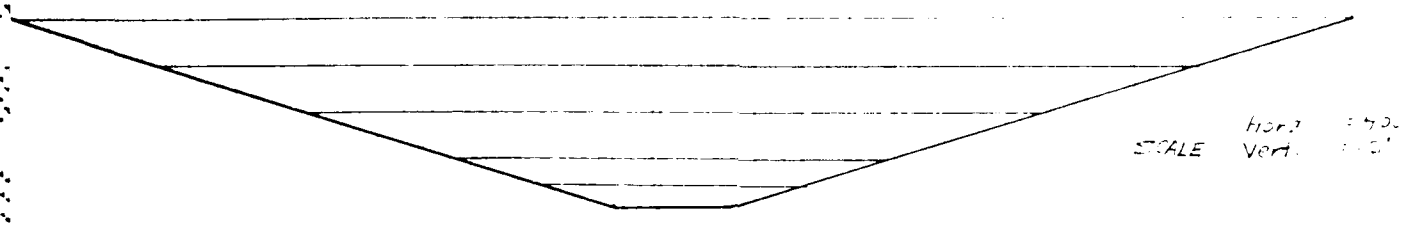
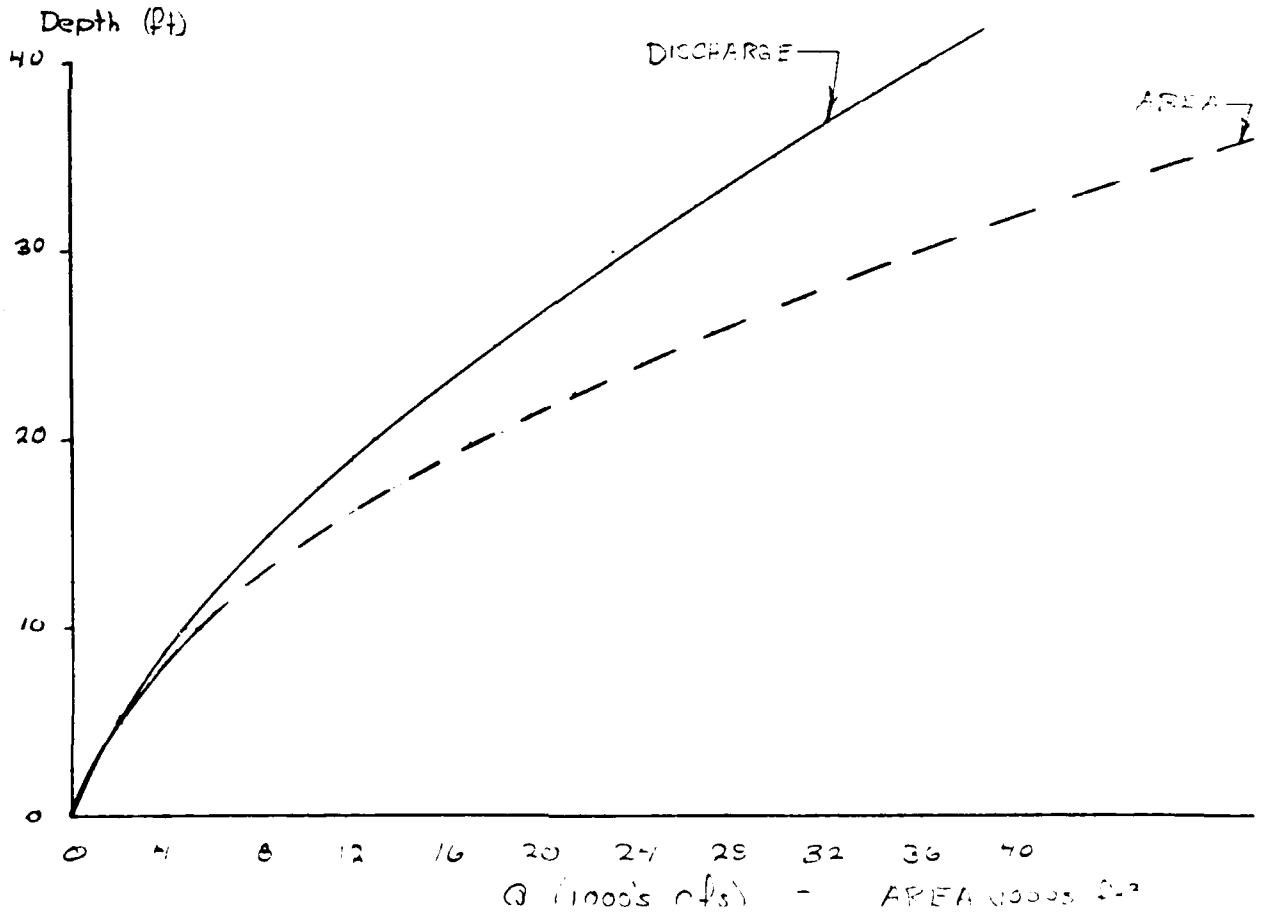
SHENIPSIT LAKE DAM
SECTION No. II

n = .035 S = .0016 1/1



D	W	A	R	$R^{2/3}$	$S^{1/2}$	V	Q
5	550	2000	3.64	2.36	.038	3.8	20941
10	950	5500	5.79	3.23	.038	5.21	41950
20	1600	19000	11.25	5.02	.038	8.10	12,959
30	2250	36000	16.0	6.36	.038	10.26	23,097
40	2950	62000	21.0	7.62	.038	12.29	36,267



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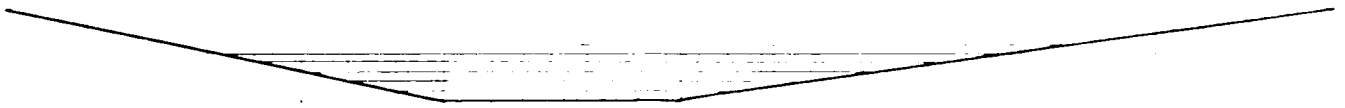
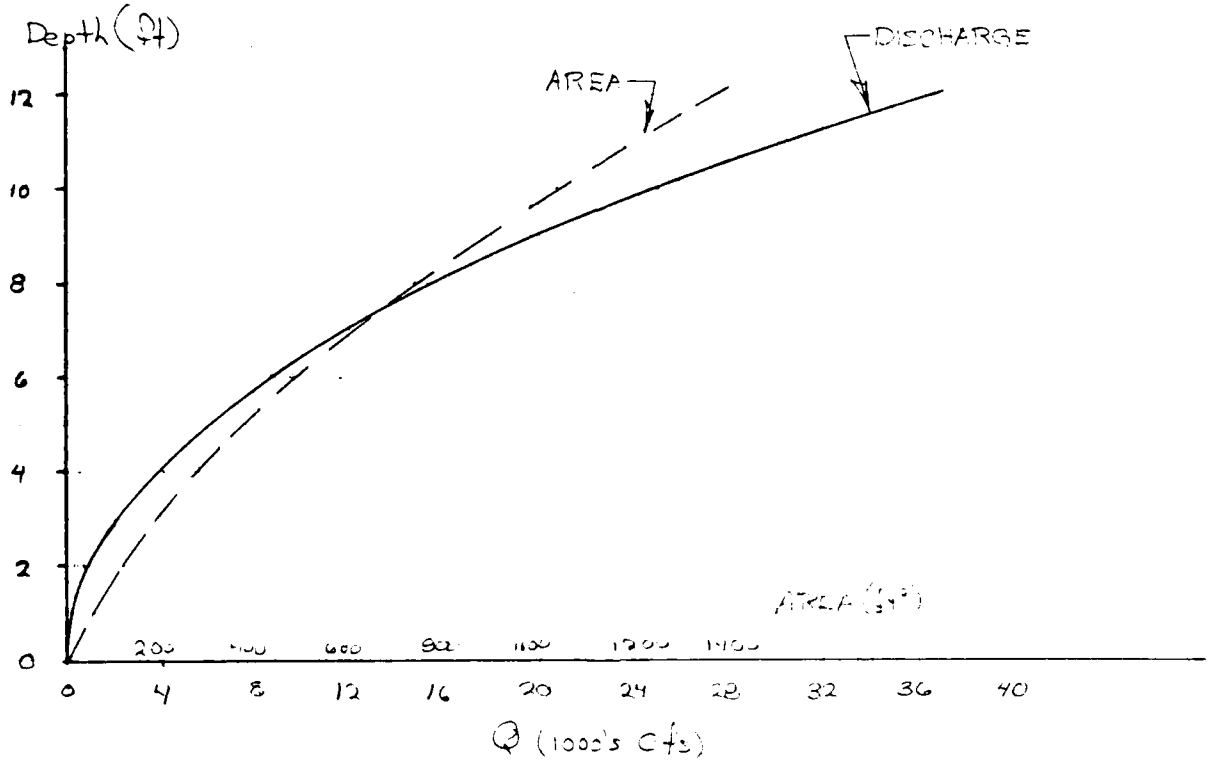
SHENIPSIT LAKE DAM
SECTION NO. I

S = .029 n = .035



D	WP	A	R	$R^{2/3}$	$S^{1/2}$	V	Q
2.0	70	120	1.7	1.42	.167	10.1	706
4.0	95	280	2.95	2.06	.167	14.6	4097
6.0	120	484	4.03	2.53	.167	17.9	8700
8.0	145	738	5.09	2.96	.167	21.0	15,520
10.0	165	1038	6.29	3.41	.167	24.2	25,150
12.0	190	1378	7.25	3.75	.167	26.6	36,700



"RULE OF THUMB" GUIDANCE FOR ESTIMATING DOWN STREAM DAM FAILUPE HYDROGRAPH.

I SECTION @ DAM

① $S = 8600$ Ac-ft

② $Q_{P1} = \frac{8}{27} W_b \sqrt{g}\, Y^{3/2} = \frac{8}{27}(100)\sqrt{32.2}\,(33)^{3/2} = 31870$ cfs

③ see stage discharge curve

II SECTION @ Rte 74 CROSSING, ROCKVILLE (use section no. I)

④ A. $D_1 = 11.3'$ $A_1 = 1250\ ft^2$

$L_1 = 10500'$

$V_1 = 301$ Ac-ft

B. $Q_{P2} = Q_{P1}(1 - V/S) = 31870\left(1 - \frac{301}{8600}\right) = 30754$ cfs

C. $D_2 = 11.0'$ $A_2 = 1200\ ft^2$

$A_{avg} = 1225\ ft^2$ $V_{avg} = 295$ Ac-ft.

$Q_{P2} = 31870\left(1 - \frac{295}{8600}\right) = 30776$ cfs

$D_2 = 11.1'$ $A_2 = 1220\ ft^2$

III SECTION @ 700' D/s from Rte 74 (use section no II)

④ A. $D_2 = 11.1'$ $A_2 = 1220\ ft^2$

$L_2 = 700'$

$V_2 = 19.6\ ft^2$

B. $Q_{P3} = 30776\left(1 - \frac{19.6}{8600}\right) = 30705$ cfs

C. $D_3 = 32.5'$ $A_3 = 4100\ ft^2$

$A_{avg} = 2660\ ft^2$ $V_{avg} = 42.7$ Ac-ft

$Q_{P3} = 30776\left(1 - \frac{42.7}{8600}\right) = 30623$ cfs

$D_3 = 35.5'$ $A_3 = 4850\ ft^2$

IV SECTION @ DART HILL RD. (use section no. II)

④ A. $D_3 = 35.5'$ $A_3 = 4850\ ft^2$ $L_3 = 21000'$

$V_3 = 3024$ Ac-ft

B. $Q_{P4} = 30623\left(1 - \frac{3024}{8600}\right) = 19,214$ cfs

C. $D_4 = 26'$ $A_4 = 2820$

$A_{avg} = 3850$ $V_{avg} = 2386$ Ac-ft

$Q_{P4} = 30623\left(1 - \frac{2386}{8600}\right) = 22127$ cfs

$D_4 = 27.5'$ $A_4 = 3450\ ft^2$

"RULE OF THUMB" GUIDANCE FOR ESTIMATING DOWNSTREAM DAM FAILURE HYDROGRAPHS.

SECTION II @ UNION POND, MANCHESTER (use section II)

(4) A. $D_4 = 27.5'$ $A_4 = 3450\ ft^2$ $L_4 = 24000\ ft^2$
$V_4 = 1900\ Ac\text{-}ft$

B. $Q_{PD} = 22,127\left(1 - 1900/8600\right) = 17240\ cfs$

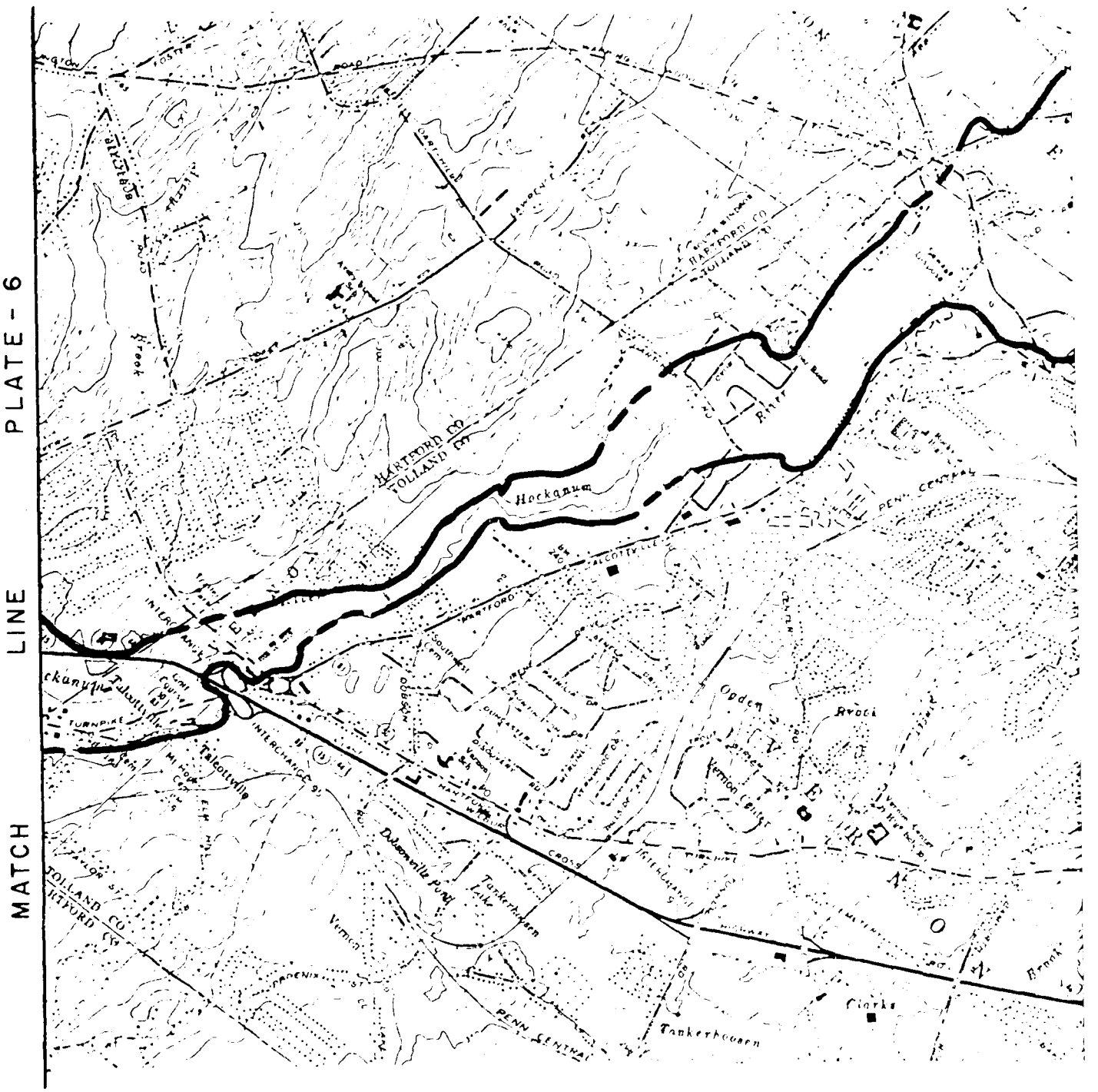
C. $D_5 = 24'$ $A_5 = 2460$
$A_{avg} = 2955$ $V_{avg} = 1628\ Ac\text{-}ft$
$Q_{PD} = 22127\left(1 - 1628/8600\right) = 17,940\ cfs$
$D_5 = 25$ $A_5 = 2600\ ft^2$

I SECTION @ LAUREL LAKE, MANCHESTER (use section I)

(5) A $D_5 = 25'$ $A_{5_1} = 2600\ ft^2$ $L_5 = 24000'$
$V_5 = 1432\ Ac\text{-}ft$

B $Q_{PD} = 17940\left(1 - 1432/8000\right) = 14,942\ cfs$

C $D_6 = 22'$ $A_6 = 2080$
$A_{avg} = 2340$ $V_{avg} = 1290\ Ac\text{-}ft$
$Q_{PD} = 17940\left(1 - 1290/8000\right) = 15,260\ cfs$
$D_6 = 22.1'$ $A_6 = 2140\ ft^2$



LEGEND

DENOTES LIMITS OF FLOODING IN CASE OF DAM FAILURE

SCALE

CONTOUR IN

DATUM IS

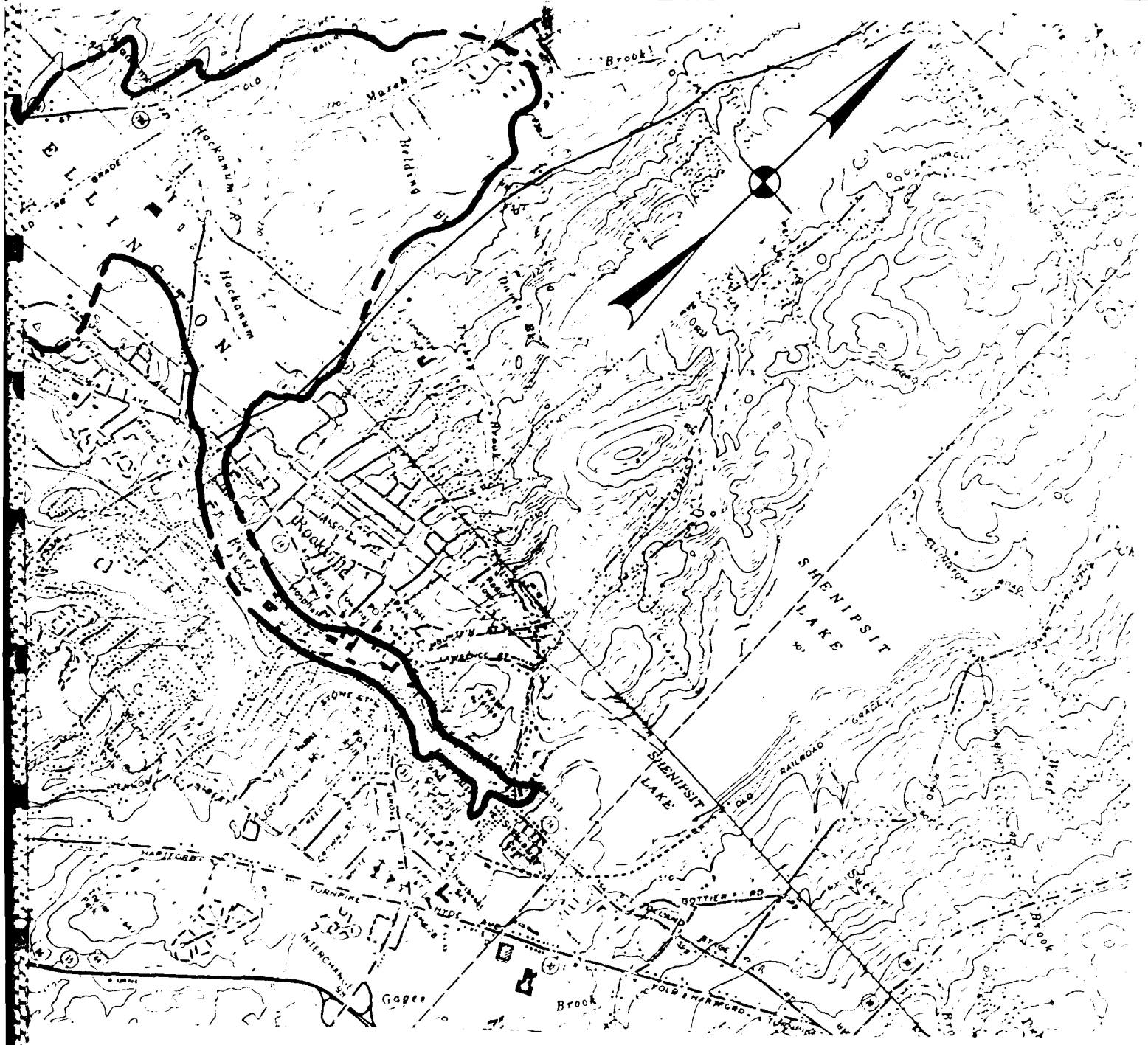


PLATE- 5

STORCH ENGINEERS WETHERSFIELD, CONNECTICUT	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

SHENIPSIT LAKE DAM

HOCKANUM RIVER — CONNECTICUT

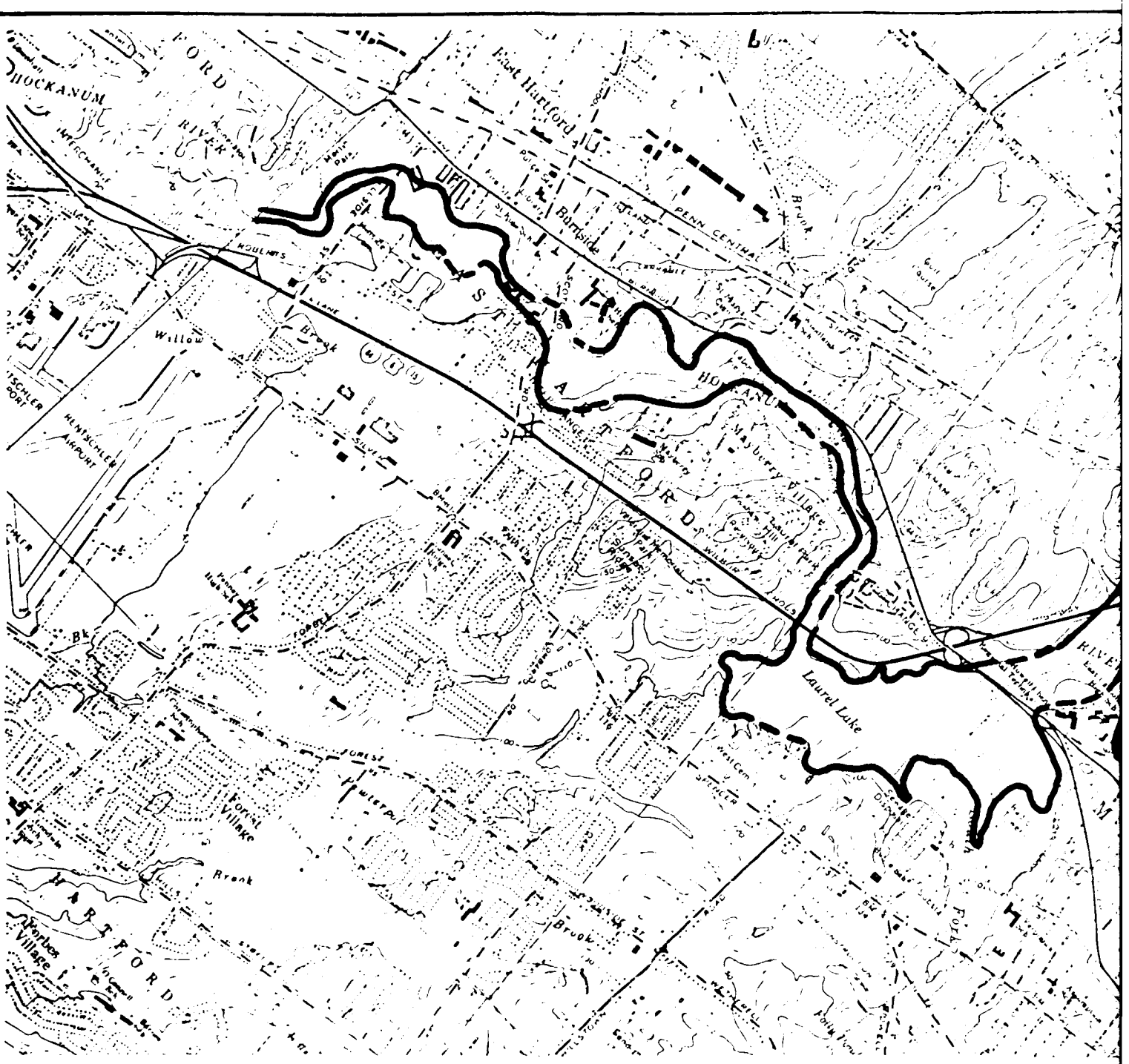
SCALE: AS SHOWN

DATE : AUGUST 1978

ALE 1 24000

INTERVAL 10 FEET

ABOVE MEAN SEA LEVEL



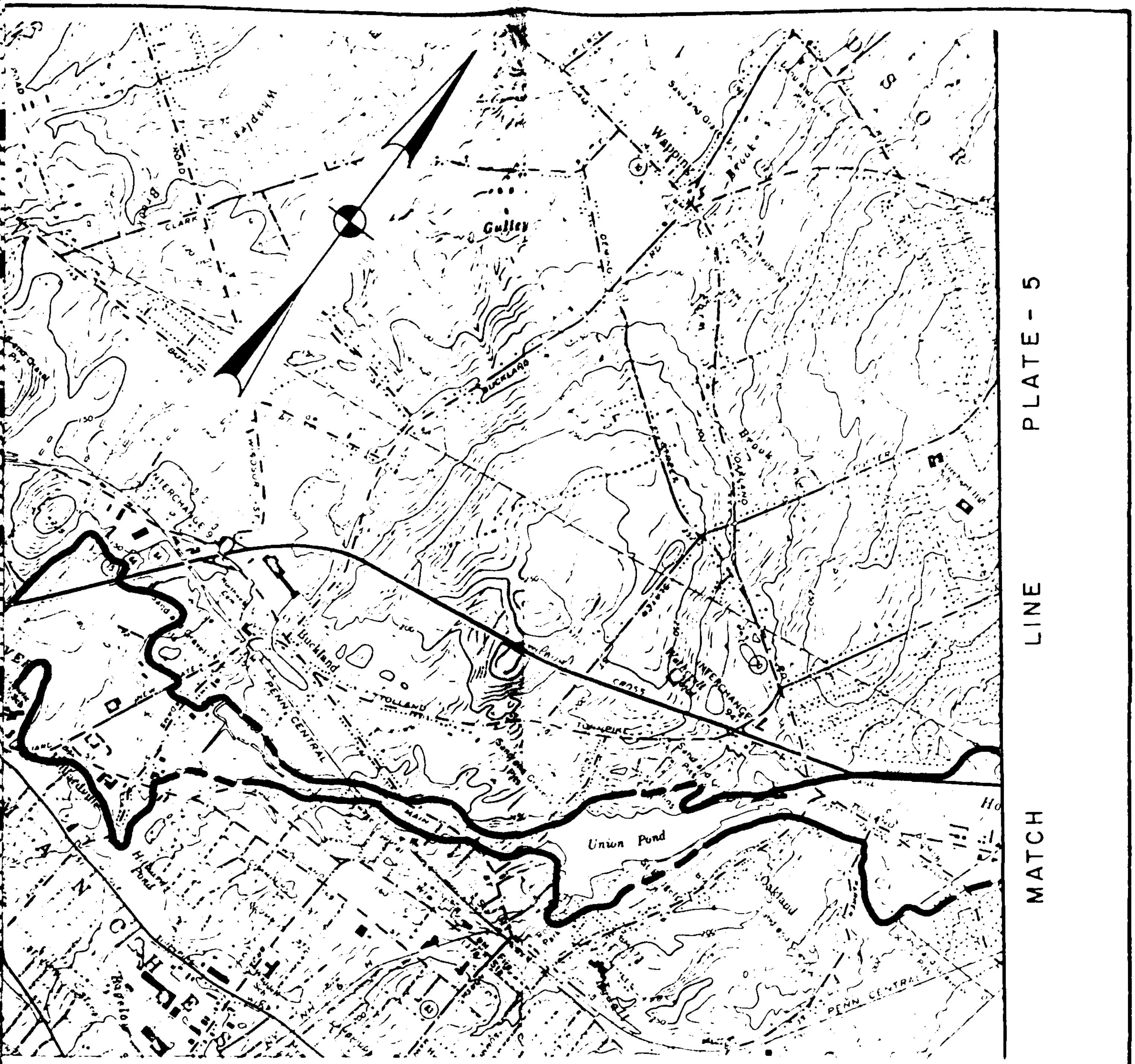
LEGEND

DENOTES LIMITS OF FLOODING IN CASE OF DAM FAILURE

SCALE 1:2400

CONTOUR INTERVAL

DATUM IS MEAN SEA



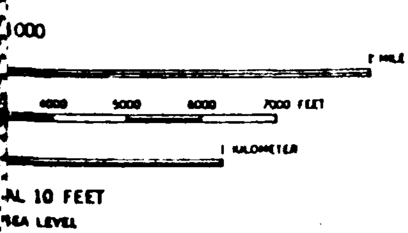


PLATE-6

STORCH ENGINEERS WETHERSFIELD, CONNECTICUT	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

SHENIPSIT LAKE DAM

HOCKANUM RIVER CONNECTICUT

			SCALE: AS SHOWN
			DATE : AUGUST 1978

APPENDIX E

INVENTORY FORMS